

Ridgewood Water District

Water Construction Standards

TABLE OF CONTENTS

I.	SUBMITTAL INFORMATION	
	1.00 General	1
	2.00 Preliminary Drawing Requirements	1
	3.00 Submission and Review Procedure	
II	WATER TRANSMISSION AND DISTRIBUTION LINES	5
	1.00 General	5
	2.00 Materials	5
	3.00 Installation	6
	4.00 Sizing of Mains	10
III.	WATER SERVICE LINES AND APPURTENANCES	11
	1.00 General	11
	2.00 Materials	11
	3.00 Installation	12
	4.00 Meters	13
	5.00 Pressure Reducing Valve (PRV)	13
	6.00 Check Valve	14
IV.	FIRE PROTECTION FACILITIES	15
	1.00 General	15
	2.00 Materials	15
	3.00 Installation	16
V.	VALVES	18
	1.00 General	18
	2.00 Gate Valves	18
	3.00 Butterfly Valves	19
	4.00 Air Release and Vacuum Valves	20
	5.00 Valve Boxes	
VI.	TRENCHING, BACKFILLING AND COMPACTION	21
	1.00 General	21
	2.00 Materials	21
	3.00 Methods and Procedures	22
	4.00 Quality Control Field	25
VIII.	PRESSURE TESTING AND FLOW TESTING	27
	1.00 General	27
VIII.	DISINFECTION OF POTABLE WATER LINES	29
	1.00 General	29
IX.	SPECIAL CONSTRUCTION	31
	1.00 General	31
	2.00 River Crossings	32
	3.00 Storage Reservoirs	32
	4.00 Pressure reducing Vaults (PRV)	33
X.	BACK FLOW PREVENTION	35
	1.00 General	35

DETAIL DRAWINGS

	<u>Detail</u>
TYPICAL CONCRETE REACTION BLOCK DETAILS	1
TABLE OF BEARING AREAS IN SQUARE FEET	2
TABLE OF VOLUMES IN CUBIC FEET	2
TRENCH CROSS SECTION	3
TYPICAL WATER SERVICE DETAIL	4
WATER LINE INSULATION DETAIL	5
FIRE HYDRANT ASSEMBLY	6
DETAIL FOR MAIN LINE GATE VALVES	7
AIR & VACUUM VALVE VAULTS	8
RIVER CROSSING DETAIL	10
CONCRETE ENCASEMENT DETAIL	10
CONNECTIONS TO EXISTING MAINS	11

I. SUBMITTAL INFORMATION

1.00 General

1.01 Scope. This section shall cover the required submittal material necessary for the Ridgewood water District to review a water project to ensure that it conforms to these regulations. Included in this section are the requirements on preliminary, final and as-built drawings, specifications, soils reports, and other supporting documents. Finally, this section will cover the submission and review procedures to be followed for the Ridgewood Water District.

2.00 PRELIMINARY DRAWING REQUIREMENTS

2.01 General. This section shall include the requirements necessary for primary drawing submittal, specifications, calculations and soils reports.

2.02 Title Sheet. The first sheet of the drawings shall be the title sheet and shall have the following shown thereon.

- A. Location map, North arrow, numerical and graphical scale.
- B. Index to sheet of the drawings.
- C. General notes.
- D. Title block. The title block should not include the words "title sheet", but should contain the project name and a description of the information shown thereon.

2.03 Plan. The following items shall be included on all plan drawings.

- A. Scale: one inch = 50 feet. Show scale numerically and graphically.
- B. North arrow.
- C. Show outline of water main and service lines. Show centerline of water line with appropriate ties to centerline of street or survey control lines, curbs, property lines or right-of-way lines.
- D. Show right-of-way and easement lines, street centerline and name, property lines, curb, gutter, cross gutters, sidewalks, driveways, paving and other improvements, existing and proposed.
- E. On each sheet of the plan, show a sufficient number of typical sections to give the relative location of surface and under-

ground improvements with respect to proposed water main. Size, type and other appurtenant data for all improvements. If a transmission line is being proposed, then both a plan and profile view shall be provided.

- F. Drawings shall be On standard 24"x36" sheets.
- G. Utilities, sewers and storm drains.
 - 1) Indicate the type, size and ownership of all existing utilities in streets or rights of way in which the water line is to be installed. Tie utilities, house sewer systems and storm drains to street rights of way centerline or to street property line.
 - 2) Indicate portions of existing utilities that are to be abandoned because of water construction.
- H. Details. At intersections where tees, crosses, valves and concrete reaction blocks are to be provided, or at any other sections of the lines where a large number of fittings will be involved, show a large scale view of the appurtenances with dimensions to each separate fitting.

2.04 Calculations. Two sets of calculations supporting the design criteria used shall be furnished with the preliminary drawings. Each sheet of calculations shall be dated and have the name or initials of individual making the calculations. All calculations shall be by a professional engineer registered in the State of Colorado.

2.05 Soils Report. A soils investigation report shall be provided with the preliminary drawings only upon special request by the Ridgewood Water District. If such a report is requested, sufficient subsurface exploration borings and analyses shall be made to permit the water system operator to make an adequate assessment of any soil problems that may be encountered. The soil investigation report shall contain the findings and supporting data for the following:

- A. The relative density type and extent of material to be encountered.
- B. Excavation problems.
- C. Location and extent of excavation.
- D. The suitability of excavated material for use as back fill or bedding.
- E. The compaction characteristics of the soils.
- F. The ground water level and conditions.

- G. The earth resistivity, moisture content, pH, degree of variation, presence of sulfates, and the likelihood of stray, direct currents.
- H. Test Holes. The depth of test holes shall be at least two feet below the proposed pipeline elevation. The spacing of test holes shall be a minimum of 600 feet or where unusual conditions exist. The spacing shall be such to adequately define soil.

2.06 Surveys. All of the existing conditions including rights of way easements and horizontal and vertical control information shall be prepared by a registered land surveyor in the State of Colorado.

3.0 SUBMISSION AND REVIEW PROCEDURES

3.01 PROCEDURES. - This section shall cover the procedures and time frame necessary to Submit water drawings to the Ridgewood Water District.

3.02 Preliminary Drawing Review.

- A. Two sets of blueprints and specifications of the proposed water system accompanied by two sets of supporting data shall be submitted to the Ridgewood Water District two weeks prior to final approval by the Ridgewood Water District. The water system operator and the Engineer shall review the preliminary drawings and specifications of the proposed water system.
- C. Should the Ridgewood Water District approve the preliminary plans, written notice of said approval shall be transmitted to the Applicant along with any modifications required by the Board or operator. Such approval of preliminary plans shall permit the Applicant to prepare final construction drawings in accordance with the standards established by the Ridgewood Water District and incorporate any modifications required by Board or water system operator.

3.03 Final Drawing Review.

- A. Final drawings and specifications shall be prepared in the form prescribed for preliminary drawing requirements. In addition, the title sheet shall provide a space for certification of approval by the Board for the Ridgewood Water District.
- B. Final drawings consisting of two sets of blue line prints shall be submitted to the Ridgewood Water District for final review two weeks before building permit is issued.
- C. If the final drawings are found to be in compliance with the Ridgewood Water District standards and these regulations and any modifications requested by the staff, the Ridgewood Water District Board shall approve the plans.

- D Approval of water plans is necessary before issuance of a building permit for the project.
- E. The Applicant should be cautioned against receiving construction bids or beginning construction until certification or approval of final plans and specifications have been received from the Ridgewood Water District.
- F. Inspection of water mains will be required per Ridgewood Water District standards. Construction inspection shall be provided under the direction of a Colorado licensed registered engineer. The inspector shall be approved by the Ridgewood Water District before commencement of the work.

3.04 As-Built Drawings. One set of as-built drawings consisting of separate transparencies of the original drawings from which clear, legible prints can be obtained, shall be submitted to the Ridgewood Water District within 30 days of completion of instruction. Said drawings shall be prepared according to the following general requirements:

- A. A certified survey shall be provided to the Ridgewood Water District which shall show the location of the water line to permanent physical objects located in the field. All valves, tees, hydrants, storage tanks and pump stations and other major appurtenances shall be given two swing ties to a physical permanent object in the field. In all cases, the distance from water line and appurtenance items shall be dimensioned to right of way easements and property lines.
- B. Spot elevations on the main water line relative to finished grade shall be provided at each 100-foot interval. In addition, all valves, fittings, and other appurtenant items shall be shown with the proper elevation. All benchmarks used on the project to determine water line depth shall be shown on the drawings and shall be based upon U.S.G.S. datum or approved equal.
- C. Manufacturer's literature and product data, including catalog sheets and descriptive literature for all materials and equipment used, shall be provided with as-built drawings.
- D. As-built drawings shall be drawn under the direction of a Colorado registered engineer to assure compliance with original design drawings. Certification shall be presented along with the as-built drawings stating such compliance.

II. WATER TRANSMISSION AND DISTRIBUTION LINES.

1.00 GENERAL.

1.01 Scope. This section shall include all materials, labor, equipment and miscellaneous items necessary to install all raw water, potable water transmission and distribution pipelines and appurtenances as specified herein for the Ridgewood Water District.

1.02 Protection of work. All pipe, fittings, valves and equipment shall be carefully handled, stored and protected to prevent damage to materials, protective coatings and linings. At no time shall such materials be dropped or dumped into the trench.

Precautions shall be taken to prevent foreign matter from entering the pipe fittings and valves prior to and during installation. No debris, tools, clothing or any other material shall be placed in the pipe during installation. Whenever pipe installation is suspended, either temporarily or overnight, the open end of the pipe shall be sealed with a water-tight plug to prevent the entrance of trench water, debris or foreign matter into the pipeline system.

Under no circumstances shall trench water be allowed to enter the pipeline. When water is present in the trench, the plug shall remain in place until the trench is pumped dry. Whenever trench water becomes evident, measures shall be taken to prevent pipe flotation.

If, in the opinion of the Engineer, the Contractor is incapable of keeping the pipe free of foreign matter during installation, the Engineer shall require the Contractor to cover the pipe ends with close woven bags until the start of the joining operation.

2.00 MATERIALS

2.01 General. This item covers the types of materials that will be required for the construction and installation of water lines. All materials used shall be new; of the best quality available, and conform with applicable standards as indicated herein. Cast iron pipe and AC pipe will not be permitted.

2.02 Ductile Iron Pipe and Fittings.

A. Ductile Iron Pipe.

1. Reference Standard - ANSI, 21.51/AWWA C151
2. Thickness Class - Minimum Class 52 unless design conditions warrant higher class pipe.
3. Pipe joints shall be push on joints except where specifically shown or detailed otherwise.

B. Plastic Pipe

1. Reference Standard – ANSI/AWWA C900-89
2. Thickness Class – Minimum Class DR-18 C900 unless design conditions warrant higher class pipe.
3. Pipe joints shall be push on joints except where specifically shown or detailed otherwise.
4. Tracer wire (6 gauge copper) shall be placed with PVC pipe in trench and extend to the surface at valves and hydrants.

C. Fittings.

1. Type - All fittings shall be mechanical joint except where specifically shown or detailed otherwise. The “Megalug” thrust restraint retainer glands are acceptable and preferable to typical thrust blocks as replacement alternative to rodding where specified.
(Manufactures reference; EBBA Iron, Series 1110. Megalug)
2. Reference Standard – ANSI A 21.11/AWWA C110 for flanged mechanical joint and push -on joints.
3. Material - Gray iron.
4. Pressure Rating - 250 psi.

C. Joints.

1. Mechanical, reference Standard – ANSI A 21.11/AWWA C111-72
2. Push on, reference Standard - ANSI A 21.11 C111-72.
3. Flanged, reference Standard - ANSI B 16.1, Class 125.
4. Every joint shall be provided with conductivity straps to provide electrical continuity at all joints. Type of conductivity strap and proposed method of installation to be approved by the water system supervisor. If plastic pipe is used, it must have tracer wire that is continuous from surface to surface points.

D. Gaskets.

1. Type – Rubber-ring gaskets shall be suitable for the specified pipe sizes and pressure.
2. Reference Standard - AWWA C111.
3. Lubricant - A non-toxic vegetable soap lubricant shall be supplied with the pipe.

- E. Protective Lining, if ductile pipe is used..
 - 1. Type - Cement mortar.
 - 2. Reference Standard - ANSI A 21.4/AWWA C104-64.
 - 3. Thickness - Standard.

- F. Couplings.
 - 1. Style - Mechanical solid sleeve is acceptable. Dresser couplings will not be accepted.

3.00 INSTALLATION.

3.01 General. All transmission and distribution lines, to be dedicated to the water system, shall be located a minimum of ten feet inside a public easement. The location of water lines within side lot line easements or rear lot easements is discouraged.

When site conditions allow, the water line should be located outside paved areas. Wherever possible, mains shall be placed in areas where snow cover will not be removed in winter. At all times water lines shall be located so that the Ridgewood Water District maintenance personnel can easily maintain and operate those lines.

Easements or rights of way used during the installation of water mains shall be a minimum width of 25 feet, 12-1/2 feet on either side of centerline.

3.02 Pipeline Depth. The minimum depth of cover of water mains and service lines shall be as follows: (Depth of cover equals depth from finished grade to top of pipe).

- A. Mains shall be buried a minimum depth of cover of seven feet (below existing or proposed grade) in all locations.

- B. When water mains are to be located underneath storm drains, culverts, or any other submerged air space, the required depth of cover may be greater than ten feet. This is necessary to ensure that the water line is beyond the frost depth associated with the storm drain culvert, etc. In some cases, the Ridgewood Water District may allow insulation in place of increased depth where water lines cross under one of the above.

3.03. Cleaning and Inspection. Clean all pipe, fittings, valves and related materials thoroughly of all foreign material; inspect for cracks, flaws, or other defects prior to installation. Mark all defective, damaged or unsound materials with bright marking crayons or paint and remove from job site. Of particular concern should be the gasket groove in the pipe bell. All spurs, excess paint, and any other defects within the gasket groove shall be either removed or repaired or the pipe shall be deemed unacceptable. Check tightness of bonnet and packing bolts on all valves.

The Contractor shall take all necessary precautions to prevent any construction debris from entering the water lines during construction of water lines and appurtenances. If debris shall enter the distribution system, the Contractor shall furnish all labor and materials necessary to clean the system. Under no circumstances will the Contractor flush the debris into an existing distribution system.

3.04 Installation. Pipe shall be laid in straight sections with bell ends facing the direction of laying unless otherwise directed by the water system operator . Where pipe is laid on grade of 1% or greater, the installation shall proceed uphill with the bell ends facing upgrade. The pipe line shall be installed so that a continuous positive or negative grade is maintained between high and low points to avoid air pockets. At no time will a high point in the line be acceptable unless an air and vacuum valve is installed to relieve air pockets. Jointing of the pipe shall be made in accordance with the directions of the manufacturer of the pipe and the manufacturer of the couplings. The allowable pipe deflection per joint, shall not exceed the maximum deflection tolerances specified by the manufacturer. Pipe bedding before backfill shall be uniform throughout, paying particular attention at the bell end.

Pipe shall be lowered into the trench with ropes, slings or machinery. Under no circumstances will the pipe be pushed off the bank and allowed to fall into the trench.

In joining the pipe, the exterior four inches of the pipe (at the spigot) end and the inside of the adjoining bell shall be thoroughly cleaned to remove oil, grit, tar, and other foreign material. The gasket shall be placed in the bell with the large round side of the gasket pointing inside the pipe so it will spring into its proper position inside the pipe bell. A thick film of the non-toxic joint lubricant shall be applied over the entire surface of the gasket. The spigot end of the pipe shall then be wiped clean and inserted into the bell to contact the gasket. The pipe shall be pushed all the way into the bell by crowbar or by jack and choker slings or backhoe. Extreme care shall be exercised when joining the pipe to avoid damaging the bell or rolling the gasket. The bell end of the pipe shall be protected by a piece of wood when pushing the pipe. Generally, every pipe has a depth of insertion stripe on the spigot end. The pipe shall be inserted to the full depth of the stripe.

The cutting of pipe for fittings or closure pieces shall be done in a neat and workmanlike manner to prevent damage to the pipe or lining. All cuts should leave a smooth end at right angles to the axis of the pipe. Flame cutting on pipe, by means of an oxyacetylene torch, will not be allowed. Once a pipe is cut, the cut end shall be beveled free of spurs which may damage rubber gaskets.

3.05 Connection to Existing Water Facilities. All main line connections between existing and proposed piping shall be made during non-business hours or at a time which is acceptable to and coordinated with the water system operator. All shut-offs shall be planned 24 hours in advance and all persons effected by the shut-off shall be given a 24-hour notice. Take all precautions to prevent contamination when making connections to existing potable water lines. No trench water, mud, or other contaminating substances shall be permitted to enter the pipeline. If connection is made to old water system (lines less than 3") a section of pipe shall be installed using solid sleeve couplings with the properly sized transition gaskets. Section of pipe replaced will be at least 10' long.

3.06 Future Connections. At intersections of new lines to old lines where the possibility may exist for a future connection, two tees and two valves should be provided. On dead-end runs of new lines, one valve should be provided at least forty (40) feet back from the thrust blocks

3.07 Protection of Water Supplies. Water lines shall be located a minimum of ten feet horizontally from existing or proposed sewer lines. Wherever the sewer line or service cross above or within eighteen inches beneath the water lines, the sewer line shall be made impervious by either of the two methods listed below:

A. Method 1. Twenty feet of ductile iron water pipe or AWWA C-900 PVC shall be used for sewer pipe and centered over the water main. Solid cast iron mechanical joint sleeve used joining the replacement sewer pipe to a sewer pipe of equal outside diameter. Extra care shall be taken during backfill operations in order to ensure the integrity of this installation.

B. Method 2
Granular backfill compacted to 95% standard proctor shall be used to prevent any settling of the higher pipe. Any work performed on other utilities, such as sewer lines owned by the others, shall conform to that particular utilities standards.

All work should be in strict conformance with the Colorado Department of Health's "Design Criteria for potable Water Systems" and the final inspection of sewer installation by water system before backfilling top of sewer line.

3.08 Reaction Anchor and Blocking. Concrete thrust blocks shall be provided as shown in the Standard Details Attachment No. 1 for all tees, elbows, bends, plugs, reducers, valves, fire hydrants, and crosses if one or more sides of the cross are plugged. The bearing area of the block shall be at least equal to that stated on the attachment. The bearing surface shall be undisturbed earth. The block shall be placed normal to the thrust as shown on the Drawings. Concrete for thrust blocks shall have 3,000 psi compressive strength. (Note: other materials other than concrete may be used in thrust blocks).

Whenever a concrete thrust block is placed, plastic sheets shall be used to prevent concrete from adhering to nuts and bolts. Any concrete splattered onto a nut or bolt will be removed before the line is backfilled.

4.00 SIZING OF MAINS.

4.01 General. All main water lines shall be sized for peak hour flow plus fire flows as required by the Fire Department at a 20 psi residual flow. Minimum size shall be 4" in diameter.

Special situations approved by the Ridgewood Water District may be acceptable with lines smaller than 4" in diameter, such as a short dead end domestic service feeder with no hydrants. These lines will be "K" copper.

4.02 Fire Flow. Fire flows required within the Ridgewood Water District boundaries for water mains are as follows:

- A. 150 gpm at 20 PSI.
- B. Absolute minimum fire flow is 150 gpm for any project.

111. WATER SERVICE LINES AND APPURTENANCES

1.00 GENERAL

1.01 Scope. This Section shall include furnishing all materials, labor, equipment and miscellaneous items necessary to install all water service lines and appurtenances as specified herein for the water system. Note: The Ridgewood Water District will own and maintain that portion of the service line from the main line up to and including the curb valve. The curb valve shall be placed on the property line; however, at all times it will fall on the water system side of the property line. All work and materials from the curb valve to the building shall be in conformance to the most recently adopted Uniform Plumbing Code. Before service line is backfilled it shall be pressurized to visually check for leaks, and witnessed by the water system operator.

2.0 MATERIALS

- 2.01 Reference Standard - AWWA 75-CR, Type K Copper.
Note: For ¾ to 2" a sizing tool is required.

Size - See No.4 below.

2.02 Corporation Stops.

- A. Material - Brass or bronze. Mueller Brand Only
- B. Size - Same as copper service line.
- C. Reference Standard -- AWWA 800-55.
Ball Corp. Only

- D. Inlet - Threaded CC type. (Only)
- E. Outlet - Copper service thread for compression (or pack joint) connection, no flaring or soldering will be allowed.

2.03 Service Saddles.

- A. For Ductile pipe - Ductile iron service saddles, "O" ring gasket, double strap, CC thread, 3/4" - 2" copper.
- B. For PVC – Single strap service saddles, “O” ring gasket, CC thread, Bronze 3/4 -2” copper. Mueller H13440 for 4”
Mueller H13441 for 6”

2.04 Curb Stop.

- A. Materials - Cast bronze body, resilient "O" ring seals, Standard tee head Operator, ball valve type. Mueller brand only.
- B. Inlet Copper service thread for compression fitting, no flaring or soldering will be allowed.
- C. Outlet - Copper service thread for compression connections.

2.05 Curb Box.

8' Mueller curb box – H10334 arch base key rod pinned to valve cap.

8' McDonald - #5607 arch base key rod pinned to valve cap.

2.06 Couplings.

- A. Materials - Compression fittings only. Mueller Brand only. NO flaring or soldering allowed.
Sizing tool is required for 1' - 2' copper.

3.00 INSTALLATION

3.01 Service Line Installation. All trenching, backfilling and compaction shall conform to Section IX of these regulations. All service lines shall be disinfected and pressure tested as per Sections VI and VII of these regulations. The water system operator must inspect all service lines before being backfilled.

3.02 Service line depth. A depth of cover for all service lines shall be a minimum of seven feet.

3.03 Tapping Pressurized Mains. The water system operator shall inspect all taps on pressurized mains. Others shall perform all taps with acceptable tapping equipment approved by water system operator before tapping. Pressurized main with service connections will be shut off for connections except for special conditions approved by the water system operator. Taps 4" and larger must have a thrust block behind the tapping tee and under the tapping valve. Taps less than, or equal to, one-half the pipe diameter of the main can be done with the fabricated steel tapping sleeves. Taps greater than one-half of the pipe diameter shall be done with cast iron tapping tees. These requirements for tapping sleeves versus tapping tees apply to mains equal to or less than 12 inches in size. Mains equal to or greater than 14 inches in size, all use fabricated steel tapping sleeves for taps less than, or equal to, one-half the pipe diameter. Taps greater than one-half the diameter will require special consideration and approval by the water system operator.

3.04 Tapping Unpressurized mains. All taps on unpressurized mains (new subdivision mains) shall be performed by the Contractor with approved tapping equipment.

3.05 Permits. An encroachment permit for excavation in County roads must be completed prior to tap. Twenty-four hour notice is required by the Ridgewood Water District prior to making taps and locating lines. Taps and locations will not be done without prior payment of the inspection fee and/or connection fee to the Ridgewood Water District.

3.06 Service Line Sizing. Service lines to be sized by Owner. The Owner is encouraged to have an engineer, plumber, mechanical contractor or architect size the service line. The Ridgewood Water District will not provide this service.

3.07 Flushing. All service lines shall be thoroughly flushed at a velocity of at least two (2) feet/second. This needs to be witnessed by the water system operator or documented.

4.00 METERS

4.01 Magnetic drive, sealed register, remote readout. Turbo meters for 3" and larger.

4.02 Manufacturer's reference - Badger meters ONLY Model 25, Bronze 5/8 by 3/4 Meter will read in 100 gallon increments

4.03 Installation. Install all meters inside the building in a horizontal position with a pre-manufactured holding device or yolk to hold meter and provide electrical bond when meter is taken out. Install in the building where meter and pressure reducing valve will not freeze. Install the remote readout on an outside wall at least four feet above grade where it is freely accessible and where falling, blowing, melting or plowed snow will not cover it. Remote shall be close to front of house.

A. Manufacturer's reference - Mueller H14-12 5/8 by 3/4 or

Watts #7 (Dual check)

- 4.05 Meter Inspection. The water operator must inspect the water meter after it is installed and before the Certificate of Occupancy is issued.
- 5.00 PRESSURE REDUCING VALVE (PRV) (For all domestic service lines.)
- 5.01 Manufacturer's Reference. Watts U-5 or equivalent
- 5.02 Installation. Install upstream of the meter. Allow for easy access to strainer and clean-out plug. See Standard Detail 5 for installation.
- 5.03 Pressure Testing. Downstream pressure to be set at 40 to 75 psi.
- 6.00 CHECK VALVE.
- 6.01 Type. Rubber or Teflon seat and spring assist.
- 6.02 Manufacturer's Reference. Watts series 600 and Ford R series or equal.
- 6.03 Installation. Install check valve before water meter where it can be isolated for repairs.

IV. FIRE PROTECTION FACILITIES.

1.00 GENERAL

- 1.01 Scope. This Section shall include furnishing all materials; labor, equipment and miscellaneous parts necessary to install fire hydrants as specified herein for the water system.

2.00 MATERIALS.

2.01 Fire Hydrants.

- A. Type - Dry barrel, traffic model with a breakaway flange assembly and coupling.
- B. Reference Standard -- AWWA C502-85.
- C. Outlet Size - One 4-1/2 inch N.S.T., two 2-1/2 inch N.S.T
- D. Hydrant Size -- 5 1/4 inch V.O. or greater, bronze to bronze seating.
- E. Inlet Size - Six inch.

- F. Operation - One and one-half inch pentagonal national standard operating nut, open counter clockwise, lubricating reservoir.
- G. Special Features - Outlet hydrants snail open when turned to the left (counter clockwise).
- H. Depth of Bury - Nine and one-half feet unless otherwise shown on drawings. (Depth of bury is from the grade line marked on the hydrant to the bottom of the hydrant.)
- I. Additional Requirements - Furnish hydrant complete with pipe and tee, six inch restrained mechanical joint gate valve and thrust blocks. Hydrant shall be restrained to the hydrant tee by 3/4" threaded rods protected from corrosion by the use of an approved bituminous coating. Furnish hydrant with bronze to bronze seating and lubrication reservoir and weather cap on operating nut.
- J. Manufacturer's Reference
 - "American Darling" No. B84B Mountain Specification.
 - "Kennedy" No. K81A Mountain specification.
 - "Mueller" Centurian A423. Mountain Specification.
- On 4" lines and for blow offs "Mueller" A411 post type 2 1/2 nozzle 2" MJ with 2" gate valve

(The hydrants specified above are the only hydrants accepted).

- K. Color - hydrant to be international red above the ground line.
- L. Rating - Standard Class 150. If existing static pressure is above 150 psi, use American Darling B508, Class 250 and allow for 6-8 weeks for delivery.
- M. Hydrant Markers - Install a six-foot long, red hydrant marker on all new hydrants. Marker to have reflective fire hydrant decal at top and to be installed On the highest flange bolt on the hydrant.

3.00 INSTALLATION

3.01 Location. Fire hydrants shall be located whenever possible at an intersection in a public right-of-way or a utility easement. There shall be a minimum of one and one-half feet between outlet nozzle and back of curb or sidewalk. In all cases, hydrants shall be located out of the direct flow of pedestrian and vehicular traffic. Wherever possible, hydrants located consecutively along a street shall be placed on opposite sides of the street so that stringing fire hoses across a street during a fire can be kept to a minimum. Hydrants shall be placed at all intersections, at end of cul-de-sacs and at all dead end runs. Water system operator shall approve hydrant location and size. "Mueller" A411 post type hydrants will be placed on all dead end lines less than 6" in diameter for flushing purposes.

3.02 Hydrant Spacing. The spacing of fire hydrants shall be determined by the water system operator or Engineer.

3.03 Installation. All hydrants must be extended so the top of hydrant is four feet above finished grade. The breakaway flange shall be located 3" above finished grade. If the previous mentioned conditions are not met after the hydrant is installed and the street is at final grade, the hydrant must be brought to proper grade by installing extensions or other modifications as required. Bag all hydrants that are not in service.

3.04 Hydrant appurtenances. All fire hydrants shall be connected to the main line by means of a mechanical joint tee with six-inch pipe branch piping to the hydrant. Each fire hydrant shall have a six-inch valve on the branch pipe conforming to standards as outlined under Section VI of these standards. The six-inch gate valve shall not be located within three feet of hydrant and shall be rodded with all thread to the main tee. See Standard Detail 6.

3.05 Hydrant restraint. The hydrant shall be restrained to the main with all rod extending from the main line tee to six-inch valve and then from the six-inch valve to the hydrant. 3/4" rods shall be tied to each joint with the use of eye bolts. A bitumastic coating to prevent corrosion, shall be liberally applied to all thread rod and eye bolts. In addition, the hydrant and main line tee shall be provided with concrete reaction blocks. See Standard detail 6.

3.06 Dry Barrel Type Drainage All hydrants shall be provided with a minimum of one-third cubic yard of 1/2 inch to 1" cleaned crushed rock and shall be placed under the weep hole outlet to assure proper drainage.

3.07 Inspection. Prior to backfilling around the hydrant, a visual inspection shall be conducted to ensure the proper operation of the weep holes. The hydrant shall be partially opened and then closed. Water in trapped in the hydrant barrel section should begin to drain. If water is not draining, then the weep holes should be cleared of any obstructions restricting the flow of water. Inspect the main valve bottom nut for proper tightness before backfilling.

V. VALVES.

1.00 GENERAL

1.01 Scope. This section shall include furnishing all materials, labor, equipment, and miscellaneous items necessary to install gate valves, butterfly valves, air release and vacuum valves, and valve boxes as specified herein for the water system. Inspect all valve-packing bolts and bonnet bolts for proper tightness.

2.00 GATE VALVES.

2.01 Materials.

A. Resilient Seat Gate Valves.

1. Size - As shown on plans – Minimum size 4”
2. Reference Standard - AWWA C550.
3. Style - Iron body, bronze stem, resilient seat gate valves, lubrication free, unobstructed through port to minimize flow, entire body encapsulated inside and out with epoxy coating.
4. Pressure Rating - 200 psi. Where existing line pressure exceeds 200 psi, a Class 250 double disk gate valve shall be provided.
Manufacturer's reference: "American Darling" #45.
5. Wrench Nut – Two inch square, open by turning to the left (counter clockwise).
6. Stem - Non-rising.

2.02 Location. Whenever possible, water main valves shall be located at street intersections. Valves must be placed on all runs of a tee or cross. For instance, each cross shall have four valves located at the intersection while tees shall have three valves located at the intersection. Valves shall be located forty (40) feet before the end of all dead end intersections for future connections, without service connections in that forty-foot interval.

2.03 Valve Spacing. Valves on cross connecting or looped mains shall be spaced such that no single break shall require more than 500 feet of line to be out of service at one time. All distribution mains connecting to transmission mains must be valved at the tie-in. Valve spacing will be approved by water system operator.

2.04 Installation. All gate valves shall be installed with the two-inch operating nut placed and true with the vertical and centered within the valve box. The water system operator will inspect the valve and valve box after installation to ensure that a valve key can easily be set on the operating nut. If valve operating nut cannot be accessed it will be repaired as necessary.

4.00 AIR RELEASE AND VACUUM VALVES.

4.01. General. This specification covers all air release, vacuum valves or combination air release valves. The type of valve used shall be dependent upon the conditions under which it will operate.

4.02. Materials.

- A. Size - To be designed by Engineer for proper application.
- B. Body - Cast iron.
- C. Float - Stainless steel.
- D. Seat - Buna.- N
- E. Pressure Rating - 200 psi.

4.03 Locations. Air release, vacuum valves or combination air release valves shall be installed to permit efficient filling or draining of long pipelines. In addition, they should provide protection against vacuum and shall continuously vent pockets of air accumulated in the pipeline. The type of valve shall depend upon the intended use of operation.

4.04 Installation. Air release, vacuum valves or combination release valves shall always be installed at the extreme high point of the distribution or transmission line. Where the vault must, out of necessity, be in a road, driveway or other traveled surface, the perimeter of the manhole vault shall be insulated with 2-inch thick extruded polystyrene hoard (Manufacturer's reference - Dow "blue board") at a depth of two (2) feet and a width of four (4) feet with 1/2" - 1" granular bedding four (4) inches thick under and on top of the insulation board. These valves shall be installed in a precast manhole vault with the fittings as shown in Standard Detail 8.

5.00 VALVE BOXES.

5.01 Materials.

- A. Material - Cast iron.
- B. Type - Three piece, screw type.
- C. Size – 5 1/4-inch diameter.
- D. Cover - Deep socket type with the word "water" cast in the top.
- E. Base - No. 160 type.
- G. Valve markers - For valves that fail outside of road pavement and shoulders, install a six-foot long, blue "carsonite" marker or post on all new valves.

5.02 Installation. Valve boxes shall be installed plumb and true, and centered over the two-inch operating nut. Bricks shall be placed under the flange of the valve box bottom so that at no time loading on the valve box will be transmitted to the valve. Valve box lid to be placed 1/2" - 1/4" below grade when located in asphalt or concrete and 8" below grade in gravel roads.

VI. TRENCHING, BACKFILLING AND COMPACTION

1.00 GENERAL

1.01 Scope. This section shall include all labor, materials, equipment, and miscellaneous items necessary to perform all excavation, backfilling and compaction of underground water lines and appurtenances as specified herein for the Ridgewood Water District. It shall be the Contractor's responsibility to secure all required excavation permits and pay all costs thereof.

1.02. Protection of work.

- A. All excavation shall be protected by barricades, lights, signs, etc., as required by governing federal, state and local safety codes and regulations. Under no circumstances, will more than 20' of trench be left open at night. Any trench left open at night will be protected by a temporary snow fence barricade and reflective tape.
- B. Sheeting, Shoring and Bracing - Where trench walls are not excavated at a stable slope, the Contractor shall provide and maintain sheeting sufficient to prevent caving, sliding or failure and property or bodily damage.

The Contractor shall be held solely responsible for any violations of applicable safety standards. Particular attention is called to minimum requirements of OSHA and State of Colorado Occupational Safety and Health laws.

C. Site Drainage - Excavation to be protected from surface water at all times.

2.00 Materials

2.01 Embedment Material. Pipeline embedment materials shall comply with the appropriate class as listed below and as illustrated in Standard Detail 3. Pipeline embedment for PVC pipe may be native material that is free from rock at the decision of the water operator or engineer if backfill complies with section 2.02

Class A - Use for all distribution and transmission mains that are ductile iron. In addition, use for all copper water service lines.

1 - Characteristics - Densely compacted 3/4" screened aggregate granular foundation, four inches below bottom of pipe with densely compacted 3/4" screened aggregate to 12 inches above top of pipe.

2.02 Backfill Material.

A. Characteristics - Made of materials free from debris, organic matter and frozen material. Uniformly graded sufficient to allow proper compaction.

B. No rocks greater than six inches in diameter in backfill.

3.00 METHODS AND PROCEDURES.

3.01 Site Preparation.

A. Clearing - Remove all vegetation, stumps, roots, organic matter, debris and other miscellaneous structures and materials from work site.

B. Topsoil Removal - Strip existing topsoil from all areas to be disturbed by construction. Topsoil to be stockpiled separately from excavated materials.

C. Pavement Removal - Asphalt and bituminous pavements to be saw cut to the full depth of pavement. The vertical face of the cut shall be a straight line parallel to the limit of excavation. Cuts shall be made with a flat-bladed air hammer, concrete saw. The method used should provide a straight, true cut. All asphalt located within trench limits to be hauled off site. Concrete pavements, including curbs, gutters and sidewalks, to be saw cut to the full depth of pavement. The vertical face of the cut shall be a straight line parallel to the limit of excavation.

All pavement removal shall be disposed of off site. Broken pavement not to be used in backfill material.

3.02 Trench Excavation.

- A. Limits of Excavation - Trenches to be excavated along lines and grades as approved by the water system of engineer. Trench widths for pipe loading to be measured 12 inches above top of pipe.

Minimum trench width to be the outside diameter of the pipe or conduit plus 16 inches.

Maximum trench width to be the outside diameter of the pipe or conduit plus 24 inches for outside pipe diameter of 12 inches or less.

Trench excavation not to be completed more than 100 feet in advance of pipe installation. Backfill to be completed within 20 feet of pipe installation by the end of any working day.

- B. Groundwater Control - Contractor to maintain facilities on site to remove all groundwater from trench. Water shall be kept at least 12 inches below the trench bottom, to a point such that a firm base for pipe or conduit installation exists. Facilities shall be maintained until all concrete is cured and backfilling is in place at least 24 inches above anticipated water levels before water removal is discontinued. All water removal shall be subject to approval by the water system or engineer.
- C. Stockpile Excavated Material - Excavated material to be stockpiled so as not to endanger the work or public safety. Maintain existing vehicular and pedestrian traffic with minimum disruption. Maintain emergency access and access to existing fire hydrants and water valves. Maintain natural drainage courses and street gutters.
- D. Clay Barriers - Install a one foot thick clay barrier, or approved equal, in place of aggregate or backfill, 1' below and 2' above pipe, every 500 feet if ground water is present in excavation area.

3.03 Bottom Preparation.

- A. Where soils are suitable and have adequate strength, bottom to be graded and hand-shaped such that the pipe barrel rests uniformly on embedment material.
- B. Bell Holes - Material to be removed to allow installation of all fittings and joint projections without affecting placement of pipe.
- C. Over-excavation - Whenever trench is over-excavated to eliminate point bearing rocks or stones or when undisturbed grade tolerances of 0.1 feet are exceeded, the Contractor is to re-establish grade using aggregate bedding materials.

D. Unstable Materials - Materials which are not capable of supporting super-imposed loadings are defined as unstable materials. Should unstable materials be encountered during excavation, immediately notify the water system or engineer. If unstable material is encountered, the trench bottom shall be over-excavated (minimum 6 inches) and backfilled with a clean 1/2" to 1-1/2" rock. The rock backfill provides increased water movement and helps stabilize the trench bottom.

E. Rock Excavation - Rock shall be removed to a four inch depth below in bottom pipe grade. Additionally, all rock loosened during jacking, blasting, etc., shall be removed from the trench.

3.04 Backfilling.

- A. Tamping Equipment - Except immediately next to the pipe, mechanical or air operated tamping equipment to be used. Hand equipment, such as T-bar, is to be used next to pipe if necessary. Care is to be taken when compacting under, alongside and immediately above pipe to prevent crushing, fracturing, or shifting of the pipe. The Contractor is to note densities required for material being backfilled and shall use appropriate approved equipment to obtain those densities.
- B. Moisture Control - Generally, maintain moisture of the back-fill material within $\pm 2\%$ of optimal moisture content as determined by ASTM D 698. Maintain close tolerances as needed to obtain densities required.
- C. Compaction - Maximum density (100%) based upon ASTM 698 or AASHTO T99.
1. Bedding Material. Includes material used for over-excavation of any kind: 95% standard proctor.
 2. Select Material: 95% standard proctor.
 2. Backfill beneath existing or proposed pavements, driveways, utility lines and other improvements or within five feet horizontally of such improvements: 95% standard proctor.
 4. Backfill within public or designated right-of-way: 90% Standard proctor
Or shown on the Drawings for those areas outside of No. 3 above.
 5. Backfill within undeveloped, green or designated area:
85% standard proctor.

- D. Placing Backfill - The maximum loose lifts of backfill material to be as follows (use smaller lifts where necessary to obtain required densities):
 - 1. Bedding and select material: 6 inches
 - 2. Backfill Material: 4 inches where 95% compaction required; 48 inches where less than 95% compaction required.
- E. Maintenance of Backfill - Contractor to maintain all backfill in a satisfactory condition during the extent of the contract and warranty period. The Contractor will be responsible for repairing any deterioration or settlement of the road surface. Notification of the required repairs will be issued by the Ridgewood Water District or engineer. All costs for repair and all liability, as a result of surface deterioration or settlement, shall be the responsibility of the Contractor.
- F. Absolutely no frozen backfill material permitted.

3.05 Surface Restoration. All existing surface improvements and site disturbed or damaged during construction to be restored to a condition equal to pre-construction condition. All restoration costs are considered incidental to the excavation and backfill.

- A. Improvements - Replace, repair or reconstruct all improvements as required. work will not be accepted until restoration is accepted by the water system or the engineer and all affected property owners. improvements include, by example, other utilities, culverts, structures, mail boxes, signs, etc.
- B. Roadways - All roadways to be restored to original condition with the following minimum depths required:
 - 1. Minimum base course material on gravel roadways or minimum depth gravel on hard surface roadways to be 8".
 - 2. Minimum bituminous surfacing to be 3".
 - 3. Minimum concrete paving to be 6".

4.00 QUALITY CONTROL - FIELD.

4.01 Compaction. It should be fully understood that it will be the sole responsibility of the Contractor to achieve the specified densities for all embedment and backfill materials placed. Contractor will be responsible for ensuring that correct methods are being used for the placement and compaction of said materials. Correct backfill methods include, but are not limited to:

- A. Use of proper equipment for existing soil condition encountered.
- B. Moisture content of existing soils; determination if water should be added or if soil should be air-dried to reduce moisture content.
- C. Thickness of backfill lift.

Contractor may, at his own expense, have an approved geotechnical engineer monitor the methods of backfill and compaction used to ensure that the desired densities are being obtained.

4.02 Inspection and Testing. Inspection and testing to be performed at the direction of water system operator or engineer. Contractor to cooperate fully with all persons engaged in testing. Contractor to excavate as required to allow testing. Contractor to backfill all test excavations in accordance with these regulations.

4.03 Density Testing and Control.

- A. Reference Standards - Density/moisture relationships to be developed for all soil types encountered according to ASTM D698 or ASSHTO T99.
- B. Field Testing - Testing for density during compaction operations to be done in accordance with ASTM D2922 using nuclear density methods.
- C. Frequency of Testing - Minimum of one (1) test for each 100 feet of trench or as directed by the water system operator or the engineer. Contractor to excavate to depths required by Engineer for testing and backfill test holes to density specified. Testing to be paid for by the Contractor.

VII. PRESSURE TESTING AND FLOW TESTING

1.00 GENERAL.

1.01 Scope. This section shall include furnishing all materials, labor, equipment, and miscellaneous items necessary to perform pressure and leakage tests all distribution, transmission, and service lines as specified herein for the water system.

1.02 Hydrostatic Tests. Pressure and leakage tests shall be conducted on the newly laid pipe and service lines. Contractor to furnish all the necessary equipment and materials to conduct the test. Contractor will be responsible for installing the appropriate taps used in the test.

The test shall be conducted between valved sections of the pipeline, or as approved by the water system operator or the engineer. Water service lines will be tested up to the closed curb stop. A visual inspection of the water service connection, at the water main and at the curb stop, will be performed to check for leakage.

Furnish the following equipment and material for the tests:

<u>Amount</u>	<u>Description</u>
2	Approved graduated containers
2	pressure gauges
1	Hydraulic force pump approved by the water system operator.
1	additional 3/4 inch pressure tap for WATER SYSTEM'S test gauge Suitable hose and suction pipe as required

Conduct the tests after the trench has been backfilled or partially backfilled with the joints left exposed for inspection, or when completely backfilled, as permitted by the water system operator. Where any section of pipe is provided with concrete reaction blocking, do not make the pressure test until at least 5 days have elapsed after the concrete thrust blocking is installed. If high-early cement is used for the concrete thrust blocking, the time may be cut to two days.

Conduct pressure test in the following manner unless otherwise approved by the water system operator. After the trench has been backfilled as specified, fill the pipe with water, expelling all air during the filling. The test pressure shall be 1-1/2 times normal static system working pressure of the pipe at the point of lowest elevation (test minimum 150 psi)

A. Duration

1. The duration of each pressure test shall be two hours, unless otherwise directed by the water system operator.

B. Procedure

1. Slowly fill the pipe with water and allow to stand for 24 hours. Expel all air from the pipe. Apply and maintain the specified test pressure by continuous pumping if necessary for the entire test period. The test pressure shall be calculated for the point of lowest elevation, or as specified by the water system operator. The pump suction shall be in a barrel or similar device, or metered so that the amount of water required to maintain the test pressure may be measured accurately.
2. Before the line is pressurized, the water system operator shall verify that all the necessary main line valves are open or closed with regard to the section of line being tested. In addition, the water system operator shall verify that all hydrant valves are open.

C. Leakage

1. Leakage shall be defined as the quantity of water necessary to hold the specified test pressure for the duration of the test period. No pipe installation will be accepted if the leakage is greater than the number of gallons per hour as determined by the following formula or approved by the water system operator.

$$L = \frac{SD \sqrt{P} H}{133,200}$$

In the above formula:

L = Allowable leakage

S = FT. of pipe test

D = Nominal diameter of pipe, in inches

P = Average test pressure during the leakage test, in pounds per square inch gauge

H = Hours of test time

D. Correction of Excessive Leakage

1. Should any test of pipe laid disclose leakage greater than that allowed, locate and repair the defective joints or pipe until the leakage of a subsequent test is within the specified allowance.

E. Air Expulsion

1. Always provide a 3/4" tap at high point in line for air expulsion.
(Any high point should have ARV all ready installed.)

1.03 Flow Test. The water system operator will conduct a fire flow test out of the hydrants pressure test is completed to gather data and verify that the system meets required fire flow and design criteria.

VIII. DISINFECTION OF POTABLE WATER LINES.

1.00 General.

1.01 Scope. Work under this section shall include furnishing all equipment, and miscellaneous items necessary to disinfect all raw water, potable water transmission and distribution pipe lines, service lines, and appurtenances as specified herein for the Ridgewood water District.

1.02 Standard. Flush and disinfect potable water lines in accordance with the procedures set forth in AWWA C601-68, Disinfecting Water Mains.

1.03 Pipe Cleaning. If the pipe contains dirt or heavy encrusted matter that in the opinion of the water system operator will not be removed during the flushing operation, the Contractor Shall clean and swab the interior of the pipe with a five percent (50,000 ppm) chlorine solution.

- A. Preliminary Flushing. Flush pipeline except when the tablet method is used, to remove all remaining foreign material. The flushing operation shall develop a minimum velocity of 2.5 ft/sec.

1.04 Chlorine Application. Chlorine shall be applied using the tablet Method.

Place tablets in each section of pipe in sufficient number to produce a dose of 50 mg/liter. Refer to Table 3 of AWWA C 601 for the required minimum number of tablets. All tablets with-in the main must be attached at the top of the pipe. Adhesive for attaching tablets to the top of pipe will be a non-toxic water soluble adhesive. Introduce water into the pipeline at a rate no greater than 1 ft./sec. and retain the water in the pipeline for a period of 24 hours. After 24 hours, a residual chlorine test shall be performed. The located water shall contain no less than 25 mg/liter of chlorine throughout the entire length. If the residual amount of chlorine at the end of 24 hours fails to meet the minimum concentrations, the line must be re-disinfected and retested .

- 1.05 Final Flushing. After the required retention period, flush all heavily chlorinated water from the main until the chlorine concentration is no higher than that prevailing in the system, or less than 1 mg/liter. Once the main line has been properly flushed, service lines shall be flushed at the curb stop.

1.06 Bacteriological Tests. After completion of the final flushing and prior to placing the pipeline in service, collect samples from the end of the line and test for bacteriological quality to show the absence of Coliform organisms. The number and frequency of samples shall conform to the requirements of the public health authority having jurisdiction but in no case shall the number be less than one. Sample bottles are available at the El Paso County Health Department. Call 578-3120 for information. Sample results shall be returned to the water system operator. Collect samples from a standard corporation stop furnished and installed by the Contractor in the main. Do not collect samples using a hose or fire hydrant.

1.07 Repetition of Procedure. If the original disinfection fails to produce satisfactory samples, repeat the disinfection procedure until satisfactory results are obtained.

IX. SPECIAL CONSTRUCTION

1.00 GENERAL

1.01 Scope. This section shall include the design and construction of river crossings, storage tanks, and pressure reducing vaults. Because each of these structures will require an engineered design to meet field conditions and individual design criteria, this section will not attempt to provide complete design guidelines and specifications. Rather, it will provide a general listing of guidelines that must be followed unless an equivalent alternative is approved by the water system operator or engineer.

3.00 RIVER CROSSING

3.01 General. This section covers the design criteria to be used on river crossings.

3.02 ENCASEMENT Pipe shall be encased in concrete for the length of pipe underneath 25-year storm high water mark. See Standard Detail 10.

3.03 Pipe. For river crossing, the pipe joints shall be push on joints with joint restraint, Manufacturer's reference -Griffin Snap-Lok pipe or equal.

3.04 Bend Restraint. All vertical bends shall be restrained with vertical reaction blocks and all thread rods between bends or between bends and concrete thrust tie.

3.05 Permits. Generally, a river crossing will require a 404 Permit or Nationwide Utilities Permit from the Army Corps of Engineers. The Applicant should begin the permit process as soon as possible, as the process can take from 30 to 90 days to secure the permit.

4.00 STORAGE RESERVOIRS.

4.01 General. This section covers the design criteria to be used on storage reservoirs. The Ridgewood Water District may allow either a buried concrete or above ground steel reservoir. The water system reserves the right to require either a concrete or steel tank depending on the field conditions, size and location of the tank.

4.02 Foundation Design. A soil and geological report shall be provided which make recommendations on the required foundation.

4.03 Structural Design. Complete structural design, with calculations and shop drawings submitted by a professional engineer shall be provided. If a welded steel tank is provided, it shall conform to ANSI / AWWA D100-79.

4.04 CDH&E Requirements. All Colorado Department of Health, Water Quality Control Division Design Criteria for Potable Water System shall be followed.

4.07 Steel Tank painting. Use an approved paint system for tank interior and exterior coating on all steel tanks.

5.00 PRESSURE REDUCING VAULTS. (PRV's)

5.01 General. This section shall cover the design criteria to be used on pressure reducing vaults.

5.02 PRV Valve. PRV valve shall be a Clayton valve as manufactured by the Cla-Valve company only. The main valve shall be a single seated, hydraulically operated, pilot controlled diaphragm type globe valve. Valve shall be epoxy coated on the interior.

5.03 Pilot Control System. Cast bronze ASTM b62 with 303 stainless steel trim. Install isolation cocks, and opening speed controls, closing speed controls with strainers on pilot controls.

5.04 Pressure Gauges. Install two 2-1/2" dial, stainless steel, and liquid filled, hermetically sealed pressure gauges with pressure snubbers, and isolation cocks. Locate at main inlet and outlet of PRV valve so that when it is isolated, gauges will still register.

5.05 Bypass Piping. Install a bypass (Cla-valve only) around main PRV valve so that mainline can be filled and service maintained with PRV valve out of service. Bypass shall be installed with an isolation valves and its own PRV. Bypass PRV shall have opening and closing speed controls.

5.06 Pressure Relief Valve. If damaging downstream pressure can result when PRV is stuck in open position, then a pressure relief valve shall be installed on downstream side of PRV on either the main line or bypass line. pressure relief valve to be piped to daylight.

5.07 Isolation Valves. Install isolation resilient seat gate valves inside of vault so that main PRV valve can be isolated.

5.08 Air Release. Install an air release and vacuum valve at the top of the pipe on both inlet and outlet of pipe in vault. Each air release valve to have an isolation valve and shall be positioned on the top of the main line pipe.

5.09 PRV Vault. All valves, appurtenances and pipe to be enclosed in a concrete or steel vault. Install link seal or equivalent between pipe inlets, outlets and vault wall. Provide aluminum manhole lid marked "water" on concrete vaults. Ladder rungs shall be provided on concrete vault. Install adjustable pipe supports under PRV, tees and valves. Inside dimensions shall be at least 8' tall and 6' wide.

5.10 Rods. Three quarter nickel/cadmium steel all thread rods shall be anchored to the outside of the vault wall and connected to the first flange of the piping inside. They shall be coated with a bituminous tar coating.

5.11 Connection for Air/Vac Valve and Bypass PRV. This connection can be made to the pipe with a direct tap, a saddle tap or a flanged tee. It shall point up vertically for proper air-vac valve operation.

BACKFLOW PREVENTION

1.00 GENERAL

1.01 Scope. This section shall include the use of backflow prevention devices to prevent cross connection.

1.02 Requirements. All work within the water system must comply with the Colorado State Health Department Law 1973: Title 25-2-114; "The primary Drinking Water Regulations for the State of Colorado", October 1981, Section 11.1.2, "Hazardous Cross Connections and the Cross Connection Control Manual" published by the Colorado Department of Health, March 1983.

In general, the law states that it is illegal to have or to maintain a cross connection on a public water supply. Cross connection is defined as any connection which would allow water to flow from any pipe, plumbing fixture or water system into a water system supplying drinking water to the public.

1.03 Types of Cross Connections. The following are common (but not limited to) cross connections and required devices to prevent backflow:

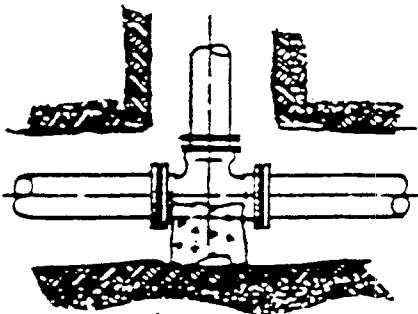
- A. Hose bibs - Vacuum breaker.
- B. Fire sprinkler systems - Approved double check valve assemblies on water only lines. Approved reduced pressure principal backflow assembly on any branch line with any chemicals.
- C. Solar houses using potable water as heat source - Double check valve assembly, water only. Reduce pressure principal backflow assembly if any chemicals are used.
- D. Photographic processors and developers - Reduced pressure principal backflow assembly.
- E. Hot water boilers - Reduced pressure principal zone backflow assembly.

1.04 Backflow Preventers. Be advised that each cross connection will require different types of backflow prevention devices, and is beyond the scope of these regulations. Approval of backflow preventers must be given by the water system operator or Engineer.

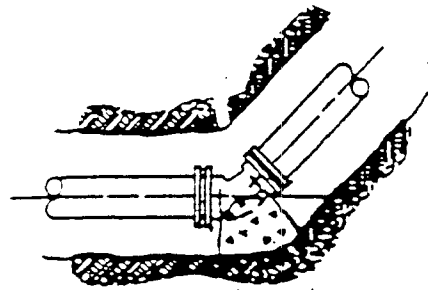
The following approved devices can be used as backflow preventers.

- A. Air gap.
- B. Double-check valve assembly.
- C. Vacuum breaker.
- D. Reduced pressure principal backflow assembly.

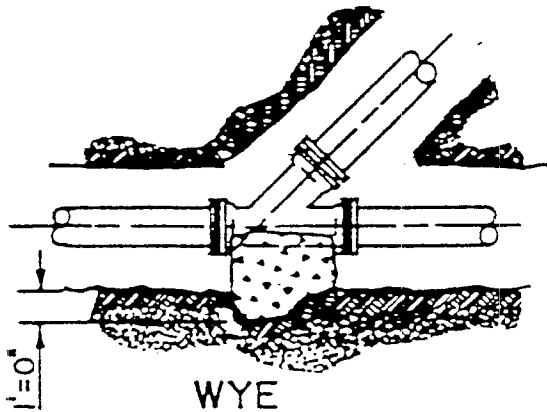
1.05 Testing. State law requires that the backflow prevention devices be tested annually by the supplier or owner and records kept by the supplier of such tests. The devices should be tested by someone certified as a backflow prevention device tester.



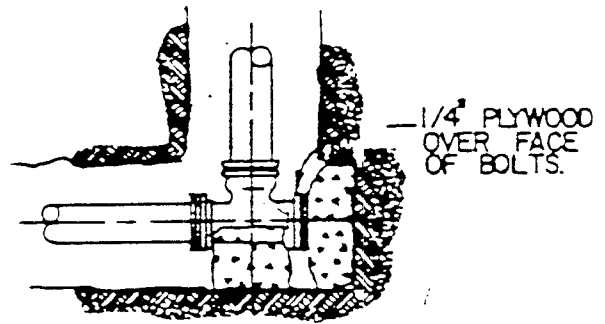
TEE



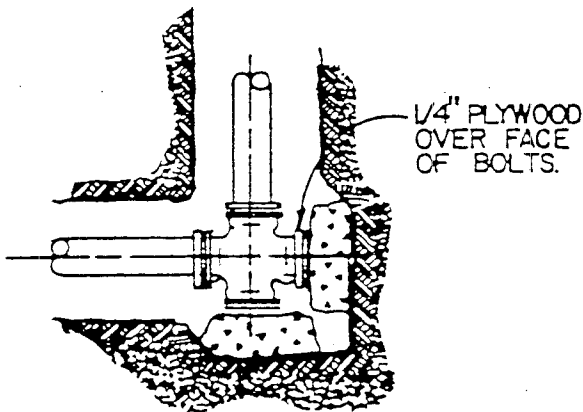
90°, 45°, 22 1/2°, or 11 1/4°
ELBOW, HORIZONTAL or
BOTTOM OF VERTICAL



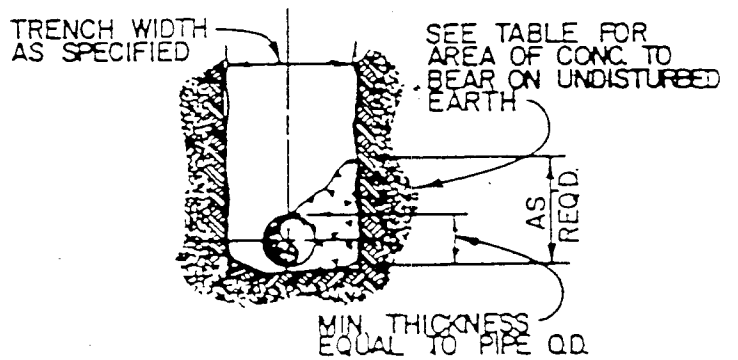
WYE



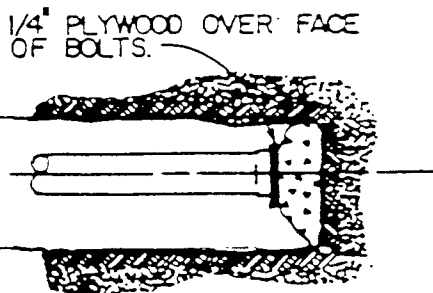
TEE W/DEAD END ON RUN



CROSS W/DEAD END BRANCHES



SECTION
(TYPICAL)

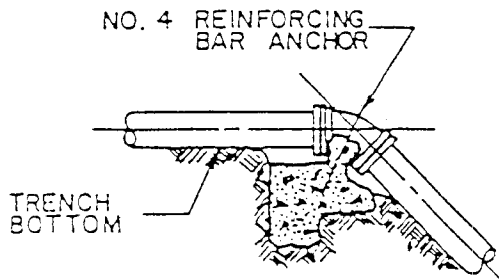


DEAD END

TYPICAL CONCRETE REACTION BLOCK DETAILS

SIZE (INCHES)	ELBOWS				TEES & DEAD ENDS	GATE VALVES
	90° (ft ²)	45° (ft ²)	22 1/2° (ft ²)	11 1/4° (ft ²)		
4	1.8	1.0	0.5	0	1.3	0.5
6	4.0	2.2	1.1	0	2.8	0.7
8	7.1	3.8	2.0	1.0	5.0	2.4
10	11.1	6.0	3.0	1.5	7.8	4.5
12	16.0	8.6	4.4	2.2	11.3	7.3
14	21.7	11.8	6.0	3.0	15.4	11.0

TABLE OF BEARING AREAS IN SQ. FT. FOR CONCRETE
REACTION BLOCK



TOP OF VERTICAL BEND

NOTE:

VOLUMES SHOWN IN TABLE ARE BASED ON 100 P.S.I. INTERNAL STATIC PRESSURE. VALUES FOR ANY PRESSURE MAY BE OBTAINED BY MULTIPLYING TABULATED VALUES BY A CORRECTION FACTOR "F".
F = ACTUAL SPECIFIED TEST PRESSURE ÷ 100.

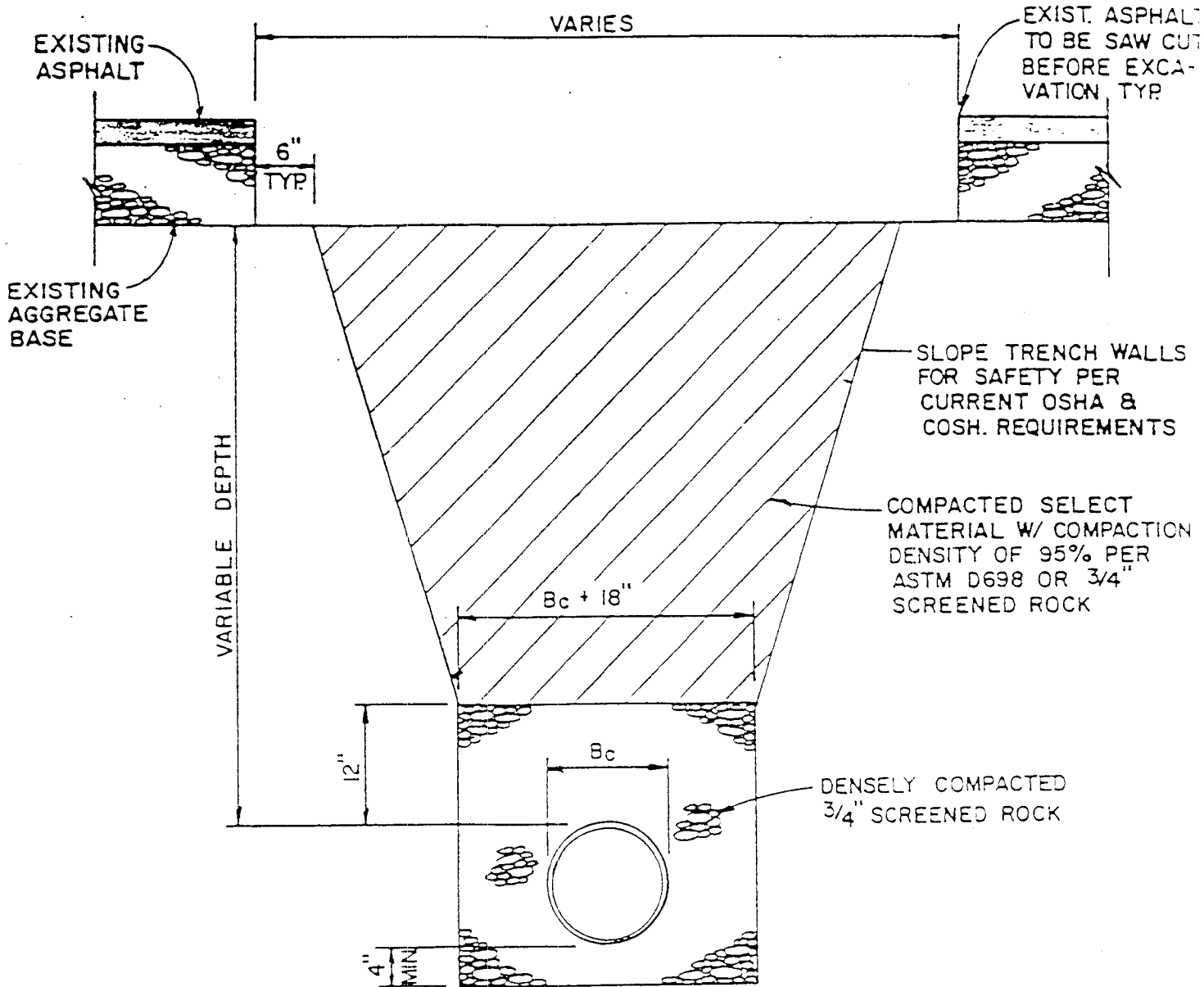
(REQUIRED FOR VERTICAL BEND ANCHOR BLOCKS FOR 100 P.S.I. PRESSURE.)

BAR SIZES FOR 100 P.S.I.	
LESS THAN	NO. OF BARS & SIZE
60 CF	1 1/2"
90 CF	1 5/8"
133 CF	1 3/4"
200 CF	1"
400 CF	2 1"
600 CF	3 1"

SIZE (INCHES)	BENDS		
	45° (ft ³)	22 1/2° (ft ³)	11 1/4° (ft ³)
4	6.5	3.3	1.7
6	14.6	7.5	3.7
8	26.0	13.2	6.6
10	40.5	20.7	10.3
12	58.5	30.0	14.8
14	79.5	40.7	20.2

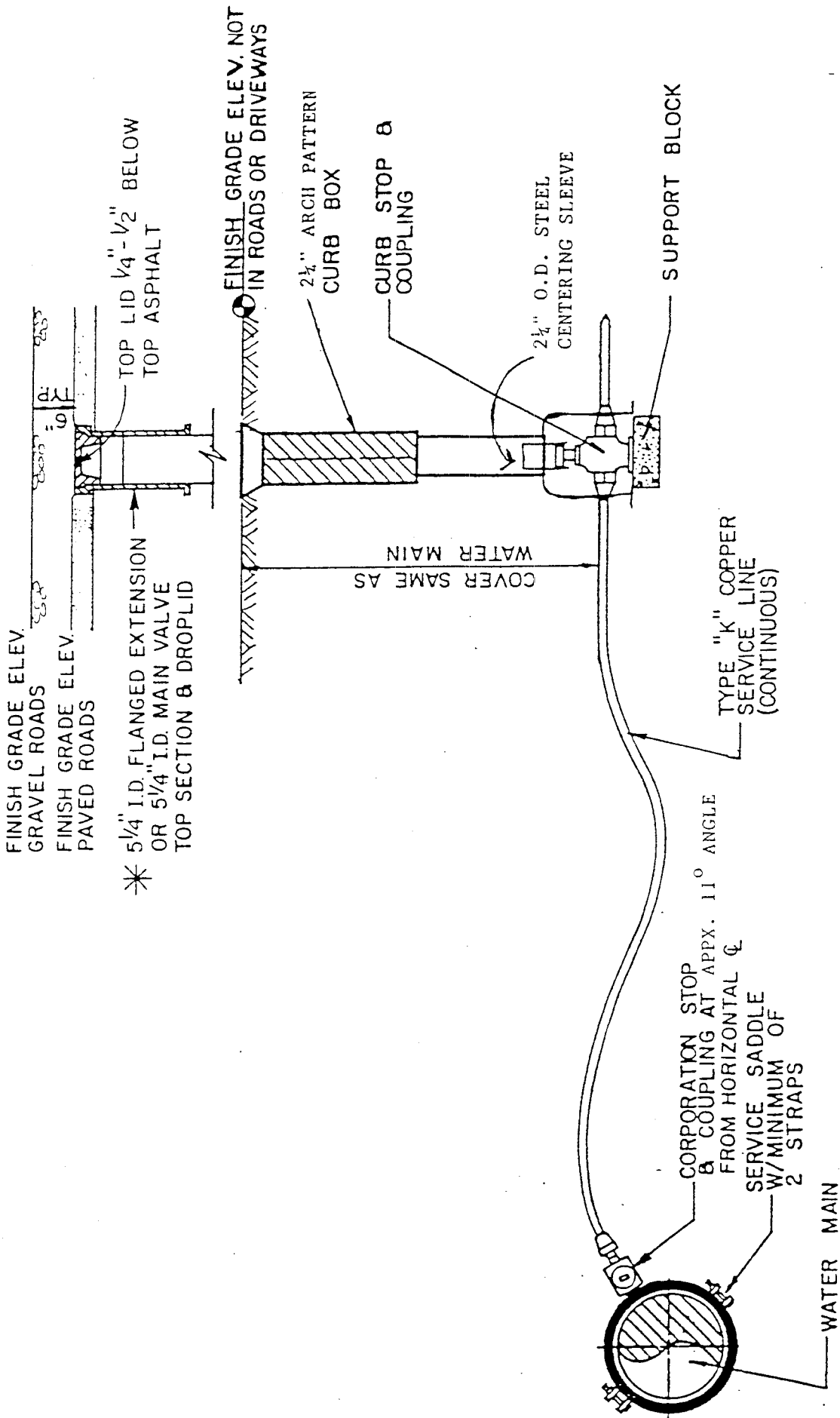
16 92 50 26

TABLE OF VOLUMES IN CU. FT. FOR CONCRETE
ANCHOR BLOCKS



TRENCH CROSS SECTION

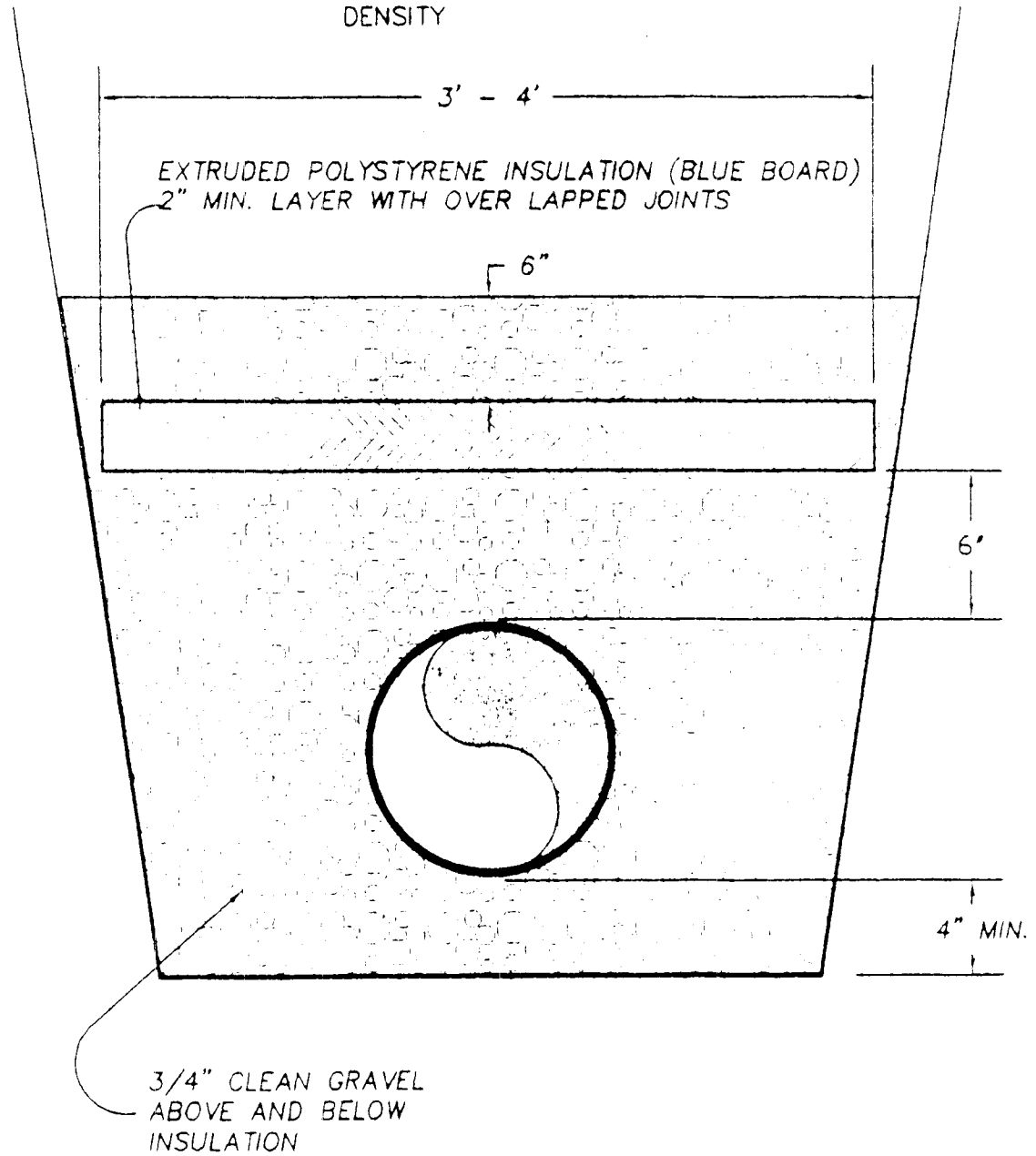
SCALE: 3/4" = 1'-0"



* ENCASE TOP OF CURB BOX IN FLANGED 5/4" I.D. EXTENSION OR 5/4" VALVE BOX TOP SECTION & DROPLID WITH THE SAME ELEVATION REQUIREMENTS AS MAIN VALVE BOXES (PAGE 20, 5.02, DETAIL 7).

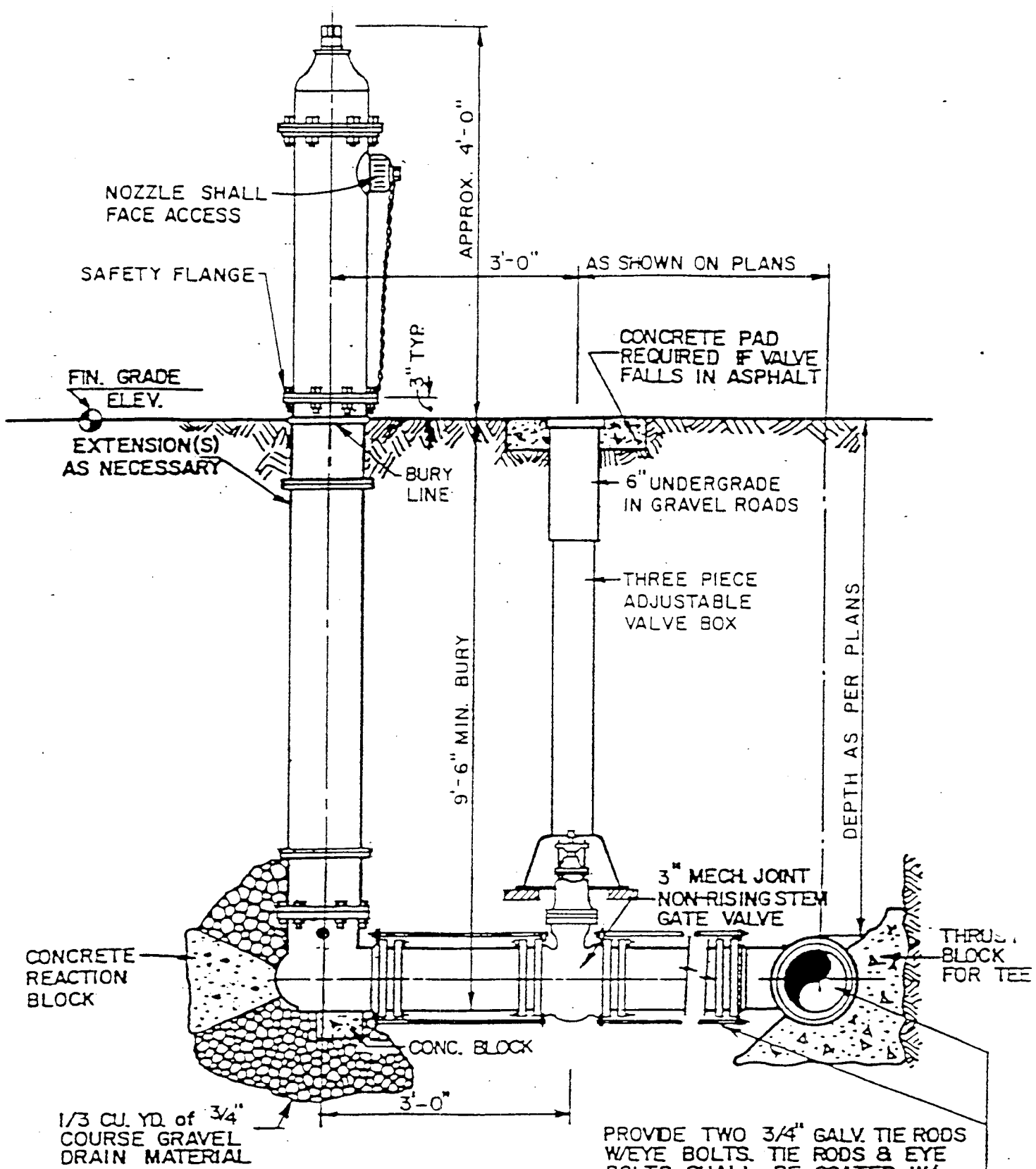
TYPICAL WATER SERVICE DETAIL

BACKFILL MATERIAL
MAX. 8" LIFTS COMPACTED
TO 95% MODIFIED PROCTOR
DENSITY



WATER LINE INSULATION DETAIL
(FOR INSULATING NEW WATER MAIN)

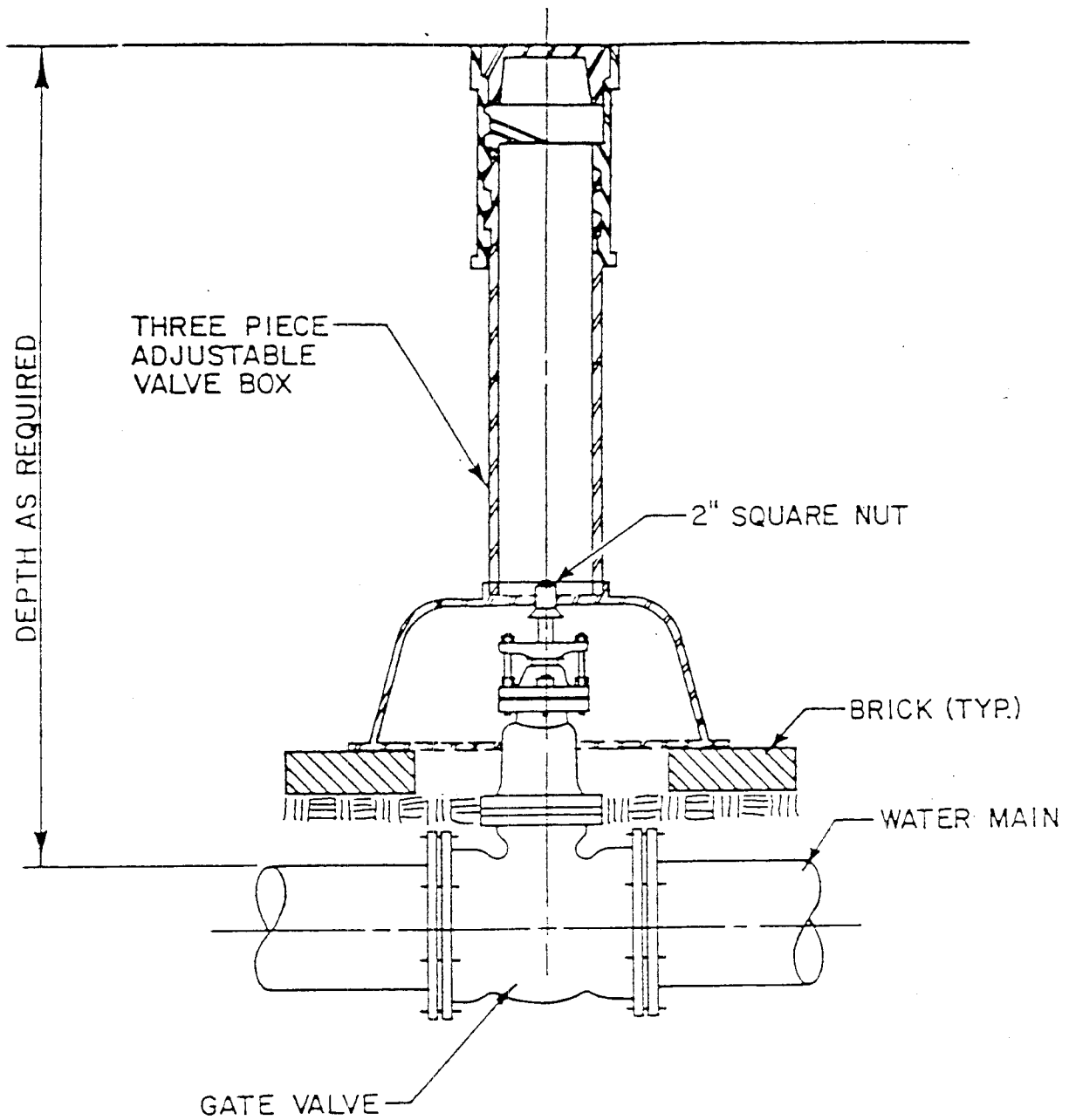
NO SCALE



NOTE:

THE HYDRANT CAN BE ADJUSTED TO FINISHED GRADE BY EITHER INSTALLING 45° BENDS ON THE 6" MAIN FEEDING IT OR BY INSTALLING APPROPRIATE EXTENTIONS ON HYDRANT BARRELL

FIRE HYDRANT ASSEMBLY



DETAIL FOR MAIN LINE
GATE VALVES

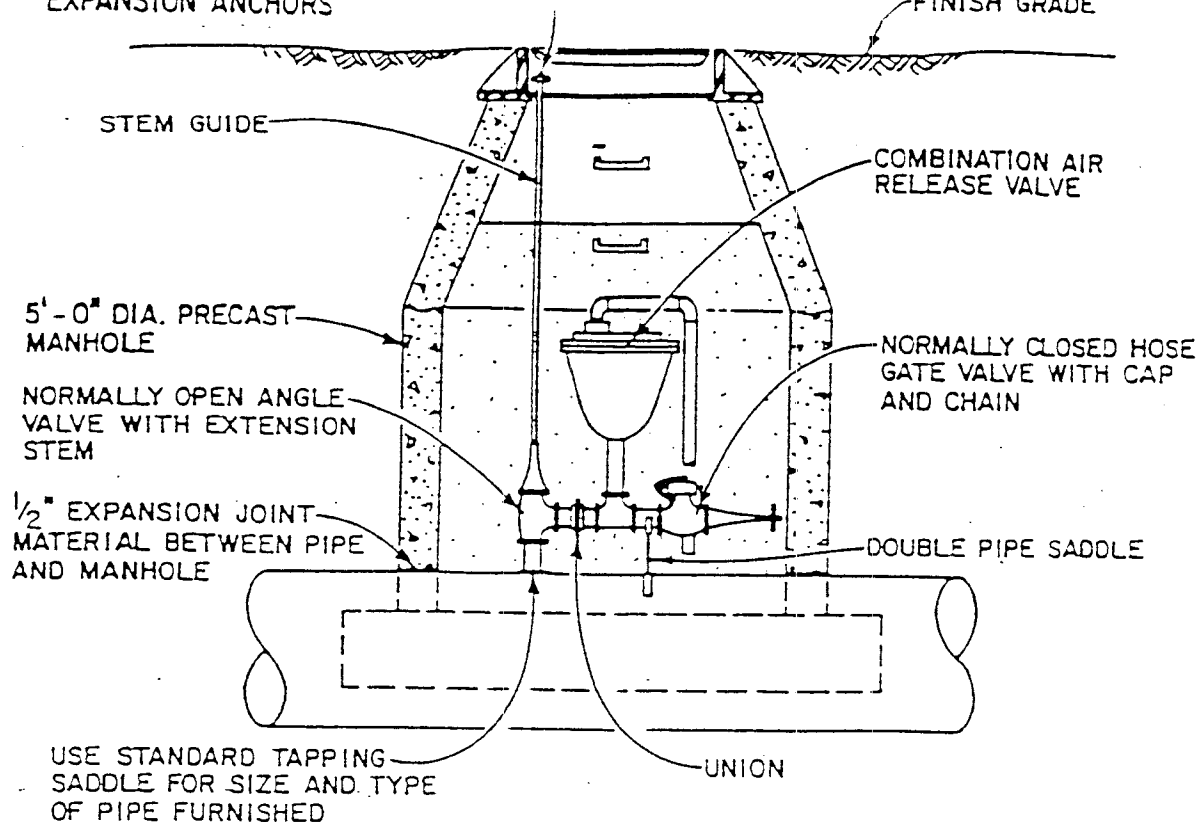
N. T. S.

DETAIL 7

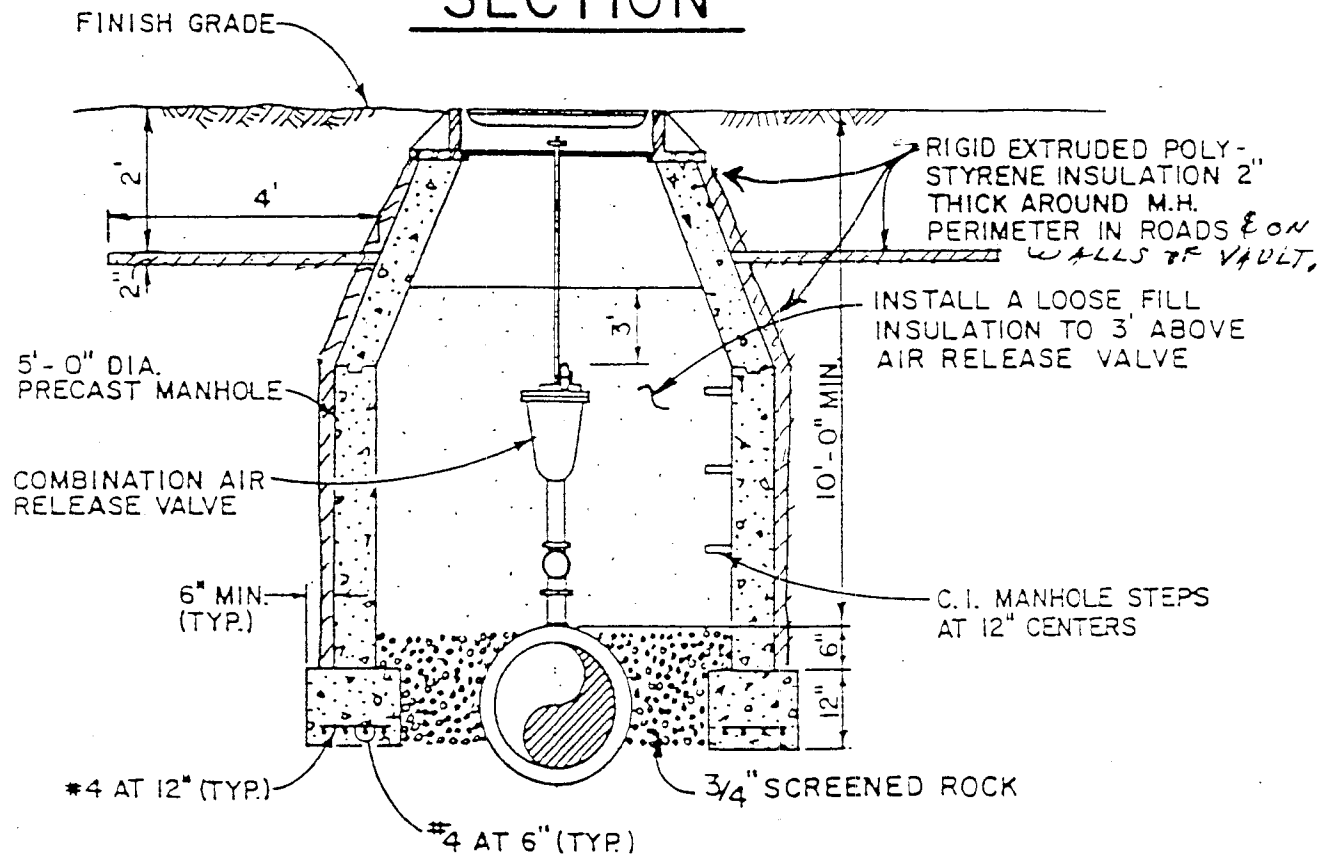
DETAIL 7

TO TOP SLAB OF MANHOLE WITH
EXPANSION ANCHORS

FINISH GRADE

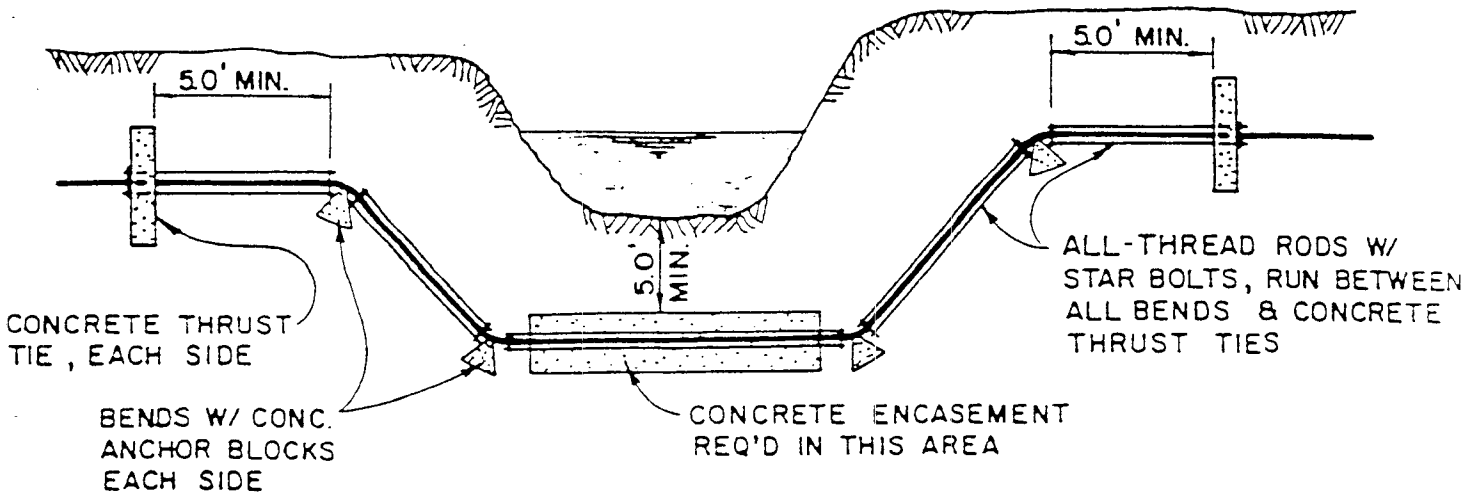


SECTION



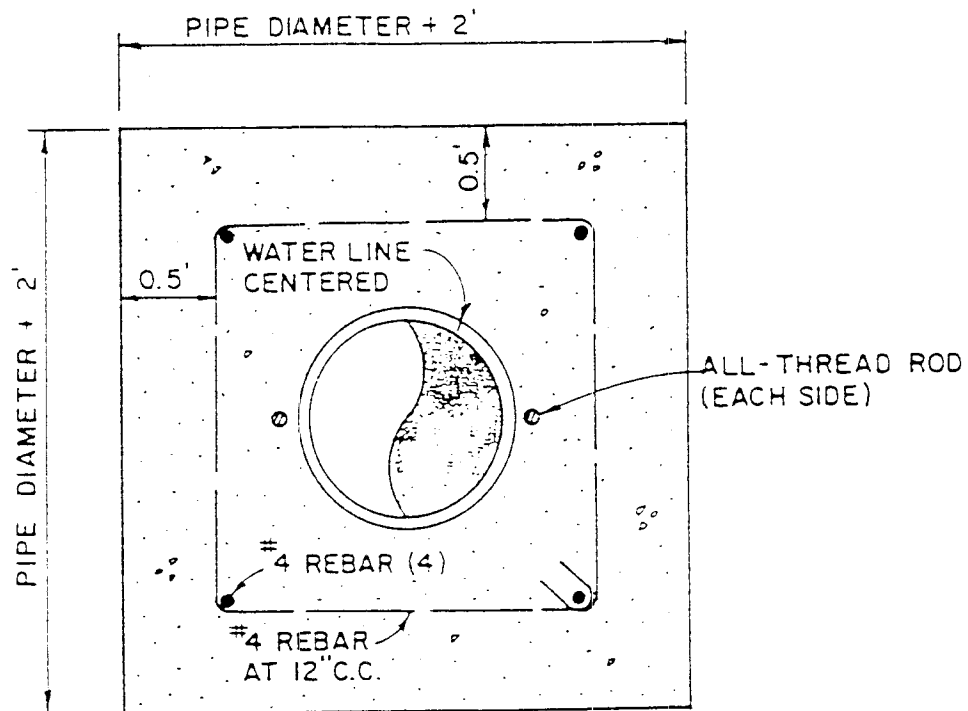
SECTION

AIR & VACUUM VALVE VAULT



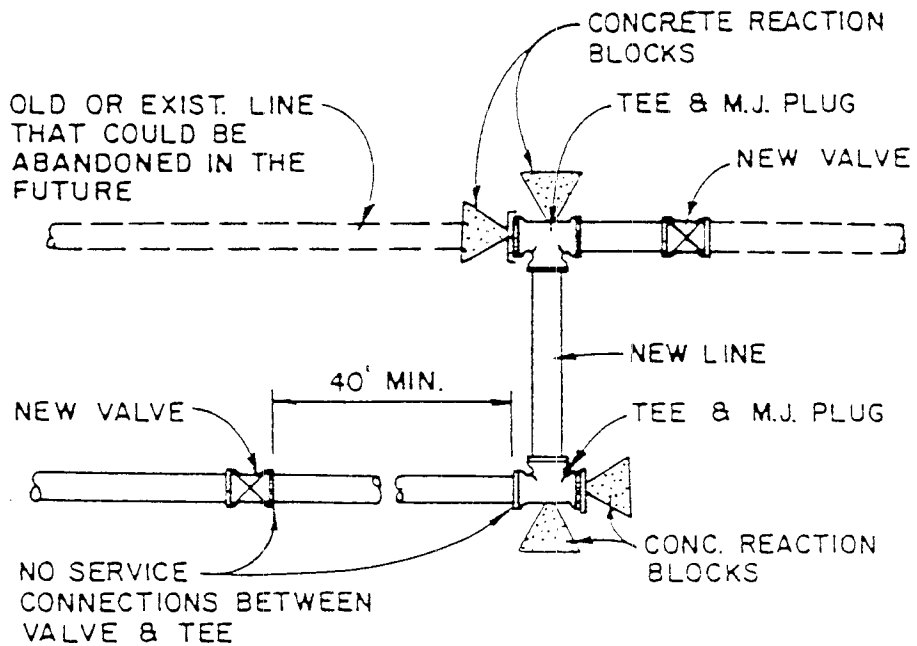
RIVER CROSSING DETAIL

N.T.S.



CONCRETE ENCASEMENT DETAIL

N.T.S.



NOTE: FOR NEW DEAD END LINES: (USE ONLY THE LOWER PORTION OF DETAIL WITHOUT A TEE IF NO EXIST. LINE IS BEING REPLACED).

CONNECTION TO EXISTING MAIN

N.T.S.